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Dentists' awareness about the link between oral and systemic health

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Abstract:

BACKGROUND: Oral health is integral to systemic health. There is a growing body of evidence of an association between periodontal and systemic diseases. The aim of the study was to evaluate the awareness of dentists regarding link between oral and systemic health.

MATERIALS AND METHODS: Data was collected using a self-administered pilot-tested questionnaire. Dentists awareness about link between oral and systemic link was assessed on five point likert scale. Data was entered and analysed using SPSS.

RESULTS: Of the 588 dentists, 500 completed the questionnaire (response rate 85.03%). About 93% of the participants (mean age 25.82 ± 4.21 years) agreed that oral health was associated with systemic health. Most dentists were aware of a connection between periodontal disease and diabetes (84.4%) and heart disease (70.2%). Similarly, 85.6% believed in the negative impact of oral disease on the quality of life of patients. More female than male dentists were aware of the relationship between periodontal disease and adverse pregnancy outcomes, diabetes, and rheumatoid arthritis ($P < 0.001$). Most dentists (97%) believed that more patients would seek oral care if they were aware of the oral-systemic link. After adjustments, private dentists were 4.65 times more likely than public dentists to believe in improving access to oral care with increased patient awareness of the oral-systemic connection ($P = 0.011$).

CONCLUSIONS: Most dentists were aware of the oral-systemic link. They believed that patients' access to oral care would improve if they were aware of a connection between oral and systemic health. Therefore, patients should be informed of the oral-systemic link to improve their oral health.

Keywords:

Dental professionals, oral care, oral health, systemic health

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Introduction

The associations between oral disease particularly periodontal disease and chronic systemic diseases such as diabetes, coronary artery disease, adverse pregnancy outcomes, and rheumatoid arthritis (RA) have been reported in observational and clinical studies.[1-4] It has been suggested that inflammatory cascade initiated by the mediators in periodontal disease can cause oral microbes, lipopolysaccharides, and proinflammatory molecules to gain access to different parts of the body, thus contributing to chronic systemic conditions and infectious diseases.[5] *Porphyromonas gingivalis*, a periodontal bacterium, has been identified as a potent agent responsible for vascular and atherosclerotic changes in cardiovascular disease.[6] Similarly, DNA analysis of synovial joint fluid of rheumatoid arthritis (RA) patients demonstrated periodontal pathogens, suggesting their role in the etiology of RA.[7] There is a bidirectional relationship between periodontal disease and diabetes mellitus. Diabetes is a strong risk factor for periodontal disease, while uncontrolled periodontal condition can enhance insulin

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resistance and disrupt glycemic control.[2] In addition, periodontal therapy has been shown to improve glycemic control in diabetic patients.[8]

Cardiovascular disease, diabetes, cancers, and lung diseases mainly account for deaths of million people in the world.[9] This rapidly rising burden of chronic diseases underscores the importance for the dental community to acquire evidence-based knowledge on oral and systemic diseases. In addition, knowledge of the oral-systemic health link among patients can have a dramatic impact on access to oral care. A survey of dentists in the United States found that awareness of associations between oral health and general health can encourage patients to seek oral care in dental practice.[10] Nevertheless, it was found that two-thirds of the patients with chronic periodontal disease were unaware of the association between periodontal therapy and systemic disease.[11]

It is important for dental professionals to update their knowledge and educate patients about the link between periodontal disease and systemic diseases, oral manifestations of systemic disease, and the impact of oral health on the quality of life of individuals. A previous qualitative study reported the perceptions of dentists on the connection between oral disease and systemic disease.[10] A better understanding of dentists on the oral-systemic link will help educate patients to improve their oral and general health by seeking the services of dental-care practitioners. Similarly, this would also lead to improved collaboration between dentists and other health-care professionals. However, the literature lacks quantitative data on dentists' awareness of these associations, the understanding of which can be significant for better oral health outcomes for patients. Therefore, the objective of the study was to report dentists' awareness of the oral-systemic link and its associated factors.

Materials and Methods

This cross-sectional study was conducted with an estimated sample of dentists working in Lahore, Pakistan. The dentists interested in the study were selected from private and public dental clinics and dental colleges in the city of Lahore, the second most populous cosmopolitan city in Pakistan in the province of the Punjab, with an estimated population of 11.1 million people in 2017. A self-administered questionnaire was developed by the researchers through an extensive literature search[1-5,8,10,11] and a comprehensive discussion of the instrument. The final form of the questionnaire was sent to faculty members in public dental health for evaluation and comment. These measures were taken to ensure adequate content and face validity and reliability of the instrument. In addition, a pool of 30 dentists was selected conveniently to pilot test the questionnaire for comprehensiveness and scope of the survey. Data of these 30 dentists were not included in the study. This also helped to improve the readability and clarity of the instrument. Further, Cronbach's alpha was calculated to measure the internal consistency of the items that evaluate the oral-systemic link and a value of 0.79 provided a good measure of internal consistency.

From the study participants, data were collected on demographic information including their type of work, year of graduation, professional qualification, average monthly income, degree awarding institution, and awareness of the oral-systemic link. Participants' attitudes were assessed using 11 items on the association between oral health and systemic health, relationship of periodontal disease with systemic diseases, oral manifestations of systemic diseases, and influence of dental conditions on the quality of life of individuals. A 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) was used for these items. For ease of statistical analysis and interpretation, responses were categorized into three: agree, neutral, and disagree. The category "agree" was created by combining strongly agree and agree options, while disagree and strongly disagree options were combined to make "disagree" category. In addition, dentist's willingness to educate patients and barriers to oral health education were recorded.

Pakistan Medical and Dental Council (PMDC), a national statutory body for physicians and dentists, maintains the register of Pakistani dentists. According to the PMDC, there were 8865 registered dentists in Punjab province in 2018. The number of dental professionals in Lahore region (>2000) was used to calculate the sample size in addition to 5% confidence limit and percentage frequency of outcome variable. A sample of 588 dentists was contacted in person for their responses. The research assistants visited public hospitals and private clinics in the city to deliver hard copies of the questionnaires. A convenience sample of dentists was recruited in the study. The dentists were contacted twice if they were unable to spare the time to complete the questionnaire on the first visit. Each subsequent visit was made 2–3 weeks later. Ethical clearance was obtained from the institutional review board. Informed written consent was obtained, and ethical standards were maintained following the guidelines of World Medical Association's Declaration of Helsinki.

Statistical analysis included descriptive statistics such as percentages, means, and standard deviations of different variables of the study. Pearson's Chi-square test was used to compare the responses between male

and female dentists, dentists with fewer and more years since graduation, and dentists with low and high monthly income. Bivariate and multivariate analyses evaluated the influence of independent variables such as type of job, years since date of graduation, basic dental qualification, and monthly income on the impact of the awareness of oral-systemic link on access to oral care. A $P < 0.05$ was used for statistical significance. SPSS software (IBM SPSS Statistics for Windows, version 22.0. Armonk, NY: IBM Corp) was employed for data entry and analysis.

Results

The response rate was 85.03% as 500 of the 588 dentists returned the questionnaire. The mean age of the respondents was 25.82 ± 4.21 years. More than half of them were females (66.2%), working in private dental clinics (79.6%), with the basic dental qualification from private dental institutions (87.6%). Of the dentists, 76.2% had ≤5 years' experience since graduation, and 79.4% had a monthly income of <500 $ U.S. [Table 1]. The participants who disagreed, strongly disagreed, and ticked the neutral options were regarded as "unaware" of the question on the oral-systemic link. Those who agreed and strongly agreed were categorized as "aware" of the item on the oral-systemic link. Awareness score ranging from 11 to 55 was calculated for 11 questions on the oral-system link. The study sample consisted of 34.2% ($N = 171$) of the participants who were aware of 11 questions on oral-systemic relationship. Of the participants, 3.6% ($N = 18$) were unaware of 11 questions about the oral-systemic link and 62.2% ($N = 311$) of the sample was aware of some but not all of the other questions on the oral-systemic link.

Table 1: Demographic characteristics of the dentists in Lahore (*n*=500)

Variables	Number (%)
Gender	
Male	169 (33.8)
Female	331 (66.2)
Type of job	
Private	398 (79.6)
Public	55 (11.0)
Both	47 (9.4)
Basic dental qualification obtained from	
Private institution	438 (87.6)
Public institution	62 (12.4)
Years since graduation	
≤5	381 (76.2)
>5	119 (23.8)
Monthly income ($U.S.)	
<500	397 (79.4)
≥500	103 (20.6)
Age, mean±SD	25.82±4.21

SD: Standard deviation

Table 2 shows the distribution of participants' responses on the oral-systemic link. Agreed and strongly agreed responses were combined to describe the results. In the study, 93.2% of the participants agreed/strongly agreed that oral health was associated with systemic health. Similarly, most respondents recognized the existence of the bilateral relationship between diabetes and periodontal disease (84.4%), oral manifestations of systemic disease (84%), and the negative impact of oral disease on the quality of life of patients (85.6%). Knowledge of an association between periodontal disease and heart disease was reported by 70.2% of the participants. The lowest commonly agreed/strongly agreed responses in the study were on the association of periodontal disease with respiratory disease at 24.4%, with kidney disease at 31.6%, and with stroke at 37%. Data were analyzed to explore the differences in responses between male and female respondents, between dentists with a monthly income of <500 $ U.S. and those with a monthly income of ≥500 $ U.S., and between participants with ≤5 years of experience since graduation and those with >5 years of experience. Agreed and strongly agreed responses were combined to provide "agree responses" and presented in Table 3. A significantly higher percent of females than males believed that oral health was related with systemic health ($P < 0.001$) and were aware of a relationship between periodontal disease and adverse pregnancy outcomes ($P < 0.001$), diabetes ($P < 0.001$), and RA ($P < 0.001$). Similarly, compared with male participants, a greater number of female respondents thought that systemic diseases manifest in oral signs and symptoms ($P < 0.001$), and oral diseases could negatively affect the quality of life of patients ($P < 0.001$).

A significantly higher percent of dentists with a monthly income of <500 $ U.S. than those with a monthly income of ≥500 $ U.S. recognized the association of periodontal disease with heart disease ($P < 0.001$), with stroke ($P < 0.001$), with diabetes ($P < 0.001$), with RA (P 0.001), and with respiratory disease (P 0.013). With regard to comparison of the years of experience since graduation, a greater number of dentists with ≤5 years of experience compared with those with >5 years of experience believed in the association between periodontal disease and heart disease, stroke, respiratory disease, oral cancer, and the quality of life and these differences were statistically significant ($P < 0.001$).

In the study, 97% of the participants believed that more patients would seek oral care if they knew of the oral-systemic link. Bivariate analysis shows that dentists in private practice than those in public clinics had higher odds (odds ratio [OR] 4.81) of believing in the awareness of the oral-systemic link and improvement

Table 2: Awareness of the dentists in Lahore about link between oral and systemic health

Responses	Disagree *N* (%)	Neutral *N* (%)	Agree *N* (%)
I know that oral health is associated with systemic health	12 (2.4)	22 (4.4)	466 (93.2)
I know that periodontal disease is associated with heart disease	51 (10.2)	98 (19.6)	351 (70.2)
I understand that periodontal disease is associated with stroke	125 (25.0)	190 (38)	185 (37.0)
I believe that periodontal disease is related to adverse pregnancy outcomes	95 (19.0)	100 (20)	305 (61.0)
I am aware of the existence of two-way relationship between periodontal disease and diabetes mellitus	38 (7.6)	40 (8.0)	422 (84.4)
I know that periodontal disease is related to rheumatoid arthritis	120 (24.0)	199 (39.8)	181 (36.2)
I understand that there is an association between periodontal disease and respiratory disease	137 (27.4)	242 (48.4)	121 (24.2)
I am aware of a relationship between periodontal disease and chronic kidney disease	100 (20.0)	242 (48.4)	158 (31.6)
I believe that a link exists between periodontal disease and oral cancers	67 (13.4)	133 (26.6)	300 (60.0)
I understand that many systemic diseases have oral manifestations which further complicate oral and systemic diseases	24 (4.8)	56 (11.2)	420 (84.0)
I am aware of the negative effects of oral disease on the quality of life of individuals	22 (4.4)	50 (10.0)	428 (85.6)

Table 3: Distribution of awareness of dentists regarding link between oral and systemic health by gender, monthly income, and years since graduation

Responses	Gender			Monthly income			Year since graduation		
	Male *N* (%)	Female *N* (%)	*P*-Value	<500 $ *N* (%)	≥500 $ *N* (%)	*P*-Value	≤5 years *N* (%)	>5 years *N* (%)	*P*-Value
I know that oral health is associated with systemic health	143 (30.7)	323 (69.3)	<0.001*	371 (79.6)	95 (20.4)	0.081	361 (77.5)	105 (22.5)	0.063
I know that periodontal disease is associated with heart disease	110 (31.3)	241 (68.7)	0.398	256 (72.9)	95 (27.1)	<0.001*	247 (70.4)	104 (29.6)	<0.001*
I understand that periodontal disease is associated with stroke	45 (24.3)	140 (75.7)	0.075	131 (70.8)	54 (29.2)	<0.001*	121 (65.4)	64 (34.6)	<0.001*
I believe that periodontal disease is related to adverse pregnancy outcomes	80 (26.2)	225 (73.8)	<0.001*	245 (80.3)	60 (19.7)	0.243	223 (73.1)	82 (26.9)	0.177
I am aware of the existence of two-way relationship between periodontal disease and diabetes mellitus	121 (28.7)	301 (71.3)	<0.001*	338 (80.1)	84 (19.9)	<0.001*	316 (74.9)	106 (25.1)	0.22
I know that periodontal disease is related to rheumatoid arthritis	37 (20.4)	144 (79.6)	<0.001*	156 (86.2)	25 (13.8)	0.001*	133 (73.5)	48 (26.5)	0.615
I understand that there is an association between periodontal disease and respiratory disease	47 (38.8)	74 (61.2)	0.789	95 (78.5)	26 (21.5)	0.013*	65 (53.7)	56 (46.3)	<0.001*
I am aware of a relationship between periodontal disease and chronic kidney disease	67 (42.4)	91 (57.6)	0.198	121 (76.6)	37 (23.4)	0.043*	114 (72.2)	44 (27.8)	0.006*
I believe that a link exists between periodontal disease and oral cancers	111 (37.0)	189 (63.0)	0.614	239 (79.7)	61 (20.3)	0.918	240 (80.0)	60 (20.0)	<0.001*
I understand that many systemic diseases have oral manifestations which further complicate oral and systemic diseases	139 (33.1)	281 (66.9)	<0.001*	323 (76.9)	97 (23.1)	0.008*	313 (74.5)	107 (25.5)	0.958
I am aware of the negative effects of oral disease on the quality of life of individuals	131 (30.6)	297 (69.4)	<0.001*	338 (79.0)	90 (21.0)	0.060	322 (75.2)	106 (24.8)	0.030*

*Statistically significant

of access to oral care (*P* 0.002). Similarly, dentists with less monthly income (OR 3.44) and ≤5 years of experience (OR 3.9) and those who had the basic dental qualification from private colleges (OR 6.59) were more likely to recognize the oral-systemic link and improvement of the access to oral care. Multivariate logistic regression showed that private practitioners in comparison with public dentists had 4.65 times higher chances of believing in an oral-systemic connection and improved access to oral care (*P* = 0.011) [Table 4]. All respondents showed their willingness to apprise patients of the association between oral health and systemic health. However, they indicated lack of time (55.2%), lack of knowledge (41%), and lack of interest in patient education (34.4%) as the main barriers to patient education [Figure 1].

Table 4: Bivariate and multivariate logistic regressions: Factors associated with dentists awareness about link between oral and systemic health

Factors	Awareness of dentists about link between oral and systemic health			
	OR (95% CI)	*P*-Value	AOR (95% CI)	*P*-Value
Type of job				
Private clinic	4.81 (1.58-14.65)	0.002*	4.65 (1.43, 15.13)	0.011*
Public clinic				
Monthly income ($U.S.)				
<500	3.44 (1.13-10.48)	0.021*	0.86 (0.15, 4.89)	0.864
≥500				
Years since graduation (years)				
≤5	3.9 (1.28-11.86)	0.01*	1.41 (0.22-9.11)	0.717
>5				
Basic dental qualification obtained from				
Private college	6.59 (2.14-20.33)	<0.001*	5.46 (0.99-29.85)	0.05
Public college				

*Statistically significant. CI: Confidence interval, OR: Odds ratio, AOR: Adjusted Odds ratio

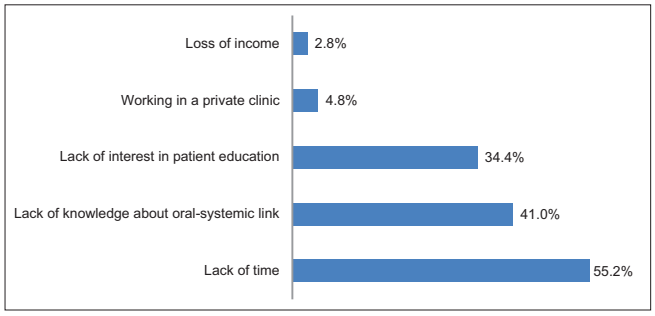

Figure 1: Barriers to patient education about the oral-systemic link

Discussion

The study demonstrated that most dentists were aware of the association between oral health and systemic health. According to the U.S. Surgeon General's Report, oral health is essential to systemic health and improved oral health can result in disease prevention.[12] The oral cavity is considered the "window to general health" and one cannot stay healthy without good oral health.[13,14] It is known that the neglect of oral problems can lead to devastating oral complications, creating financial and social burdens, and compromising the quality of life of patients.[12] A recent epidemiological cohort study over 44 years reported increased risk of mortality associated with poor oral health.[15]

There is a strong association between periodontal disease with coronary heart disease and myocardial infarction.[16,17] In addition, periodontal microorganisms have been shown to be associated with dyslipidemia, atherosclerosis, and hypertension.[18-20] However, it is not fully understood if this relationship is causal, and there is no conclusive evidence in this regard.[16,17] The American Academy of Periodontology supports the American Heart Association's statement that points out that there is an association between periodontal disease and heart disease independent of common risk factors. The academy emphasizes that patients and health-care providers should be aware of the increased risk of heart disease due to periodontal disease.[21] Clinical studies have shown that periodontal treatment can cause a reduction in serum cholesterol and inflammatory markers (interleukin-6, C-reactive protein)[22] and an improvement in endothelial functions[23] and atherosclerotic profile.[24]

An even stronger relationship is found between periodontal disease and cerebrovascular disease.[17] A meta-analysis of cohort studies found significantly increased risk of stroke (relative risk 1.63) with periodontal disease.[25] A recent study confirmed an association between periodontal disease and incident ischemic stroke, and regular dental care was found to reduce the risk of stroke.[26] Moreover, a true bidirectional relationship has been established between periodontal disease and diabetes, and it has been shown that the treatment of one condition can positively affect the other.[2,27] A strong correlation was observed between successful periodontal treatment and full-term birth (OR 6.02; 95% confidence interval 2.57–14.03).[28] In our study, most participants were aware of the link between periodontal disease and chronic systemic disease, which is consistent with the current body of evidence. Likewise, in a previous qualitative research, dentists predominately discussed the connection of periodontal disease with heart disease, diabetes, and pregnancy outcomes.[10]

In a previous qualitative study, the dentists suggested taking care of oral and general health of patients as primary care providers, and some strongly believed that patient education of oral-systemic link was crucial to the provision of optimal dental care.[10] This is in agreement with our study in which a large majority of dentists (97%) believed that the awareness of the link between oral and systemic health among patients could increase

the number of patients seeking dental care. Dentists from the private sector were 4.65 times more likely to recognize the impact of the oral-systemic link with the improvement of access to oral care than dentists from the public sector. This is probably because dentists working in private clinics run the dental practice as a business. Therefore, they can better evaluate the impact of a greater number of patients seeking oral care on the productivity and profitability of their clinics. In contrast, government pays salaries and other benefits to the dentists who work in the public sector,that is why public dentists were less likely to assess the impact of dental care utilization on the income of their practice.

The present study showed that a significantly higher number of dentists with smaller monthly incomes than those with higher monthly earnings were aware of an association between oral and systemic health, including the connection of periodontal disease with some systemic chronic diseases ($P < 0.001$). It is possible that dentists with less monthly income have a smaller number of patients in their dental practices and therefore may have more time to update their knowledge on oral and systemic conditions. Similar trends of greater awareness of oral-systemic link were observed in our study of female dentists and those with <5 years of experience after graduation. Previously, it was found that female dentists worked fewer hours per week than male dentists.[29] Therefore, it is possible that female dentists had more time to read on the latest dental research, which perhaps explains why more females were aware of the oral-systemic link. It is possible that dentists who recently graduated were more likely to recollect information than those who graduated many years ago. This may point out to the lack of opportunities for continuing education development for practicing dentists or the lack of avenues and resources in the country for updating their scientific knowledge.

Globally, more than 54 million people died mostly because of heart disease, diabetes, cancers, and respiratory disease in 2013.[30] The prevalence of these diseases is rapidly increasing worldwide and so is the population of older people, which is complicating the situation. More than 100 systemic conditions demonstrate oral manifestations, and about 500 medications can cause oral signs and symptoms.[31] Moreover, increasingly greater proportions of elderly populations are retaining their natural teeth and consequently require dental care.[32] Nevertheless, low health-care costs are needed for the patients with good oral health.[33] Therefore, educating patients on the importance of a connection between oral and systemic health can be valuable in maximizing the health-care benefits to patients.

Our study has provided useful evidence from a large sample of dentists that can be utilized to improve the knowledge and understanding of dental community to enhance oral seeking behaviors of patients. Nevertheless, there were certain limitations. The present data may not truly represent a large community of dentists from a highly populous city because the sample comprised mostly females, dentists with basic dental qualifications obtained from private dental institutions, and dentists who worked in private dental offices. Moreover, there is a possibility of over-reporting of responses as the dentists may express their awareness of the oral-systemic link but may not routinely appraise relevant latest evidence. A future study should try to discover whether the provision of knowledge about the oral-systemic link actually increased the number of patients seeking oral care or increased the number of routine dental visits or increased the number of dental procedures provided to the patients.

Conclusions and Recommendations

The study found that most dentists were aware of the association between oral health and systemic health. The relationship between periodontal disease and diabetes, and heart disease was recognized by a large majority of dentists. Similarly, most dentists acknowledged the negative impact of oral disease on the quality of life of patients. A majority of dentists agreed that more patients would seek dental care if they knew the link between oral and systemic health. The lack of time and of knowledge were the most common barriers to educating patients on the oral-systemic connection.

It is suggested that continuing education programs should focus on educating dental, medical, and other health-care professionals on the robust and latest evidence of the oral-systemic link. While educating patients, strong and updated evidence should be shared with them, but claims about the causal relationship of periodontal disease with other systemic conditions must be avoided. Dentists, physicians, and allied health-care professionals should utilize these findings to improve access to oral care and enhance oral health of the patients. General physicians and other health-care providers should continually familiarize themselves with the latest research on the link between oral and systemic health. They should establish strong collaborations with dental professionals for an efficient referral system. This would improve the quality of life of individuals and empower them to stay healthier.

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Conflicts of interest

There are no conflicts of interest.

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